Space Weather Technical Forecast

Issued on Sunday, 25 August 2024 at 13:04 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Moderate Solar Activity with further M-class flares expected. Chance of G1 Minor Storm intervals Day 3 (27 Aug) from CME arrival.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with four M-class flares observed, peaking M1.7 at 24/2324 UTC from AR3800.

There are twelve regions on the Earth-facing disc. AR3800, near south-centre disc remains the most likely and notable flare source, consisting of a string of smaller spots, but including a small delta configuration in its easternmost intermediate spots. AR3790 in the southwest has been relatively stable in recent hours, and remains a relatively inactive region. Some slight decay also continues to be observed in both AR3796 and AR3801, while AR3799 has stabilised to become the largest region on the disc, but maintains a simple bipolar structure. The other regions, including small emergent spots, remain very small and simple. There is an area of magnetic looping evident over the northeast limb on SDO, and this is likely the sign of a further region that will soon move onto the disc.

No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Slow wind conditions dominated. Solar wind speed, as measured by ACE at L1, was at background, between 350 and 380 km/s. Density was around or just below average. Interplanetary Magnetic Field (IMF), Bt, was weak, around 4-7nT. The north-south component, Bz, varied between -6nT and +4nT, but was predominately negative (southward). Phi angle was mainly positive (away from the Sun). Geomagnetic activity was Quiet to unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background. High energy electron flux (greater than 2MeV) observed at GOES16 was at background. The 24-hour fluence was below the Active threshold, with 1.66e6 integrated pfu observed at 25/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are expected with a slight chance of isolated X-flares.

Solar Wind /Geomagnetic Activity: A CME from the filament eruption near AR3794 just after 23/0100UTC has been reassessed as passing mainly ahead of Earth, but with a glancing impact now likely early Day 3 (27 Aug). There are no other Earth-directed CMEs. No coronal hole influences are expected, with background solar wind speeds generally persisting. Mainly Quiet geomagnetic activity is expected with a slight chance of Unsettled spells. There is a chance of Active to G1 Minor Storm with any CME glance, most likely Day 3 (27 Aug).

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background, but with the potential to rise in response to any notable flares, giving a slight chance of reaching the S1 Minor Radiation Storm level. High energy electron flux is expected to remain at background levels. The associated 24-hour fluence is expected to persist below the Active level.

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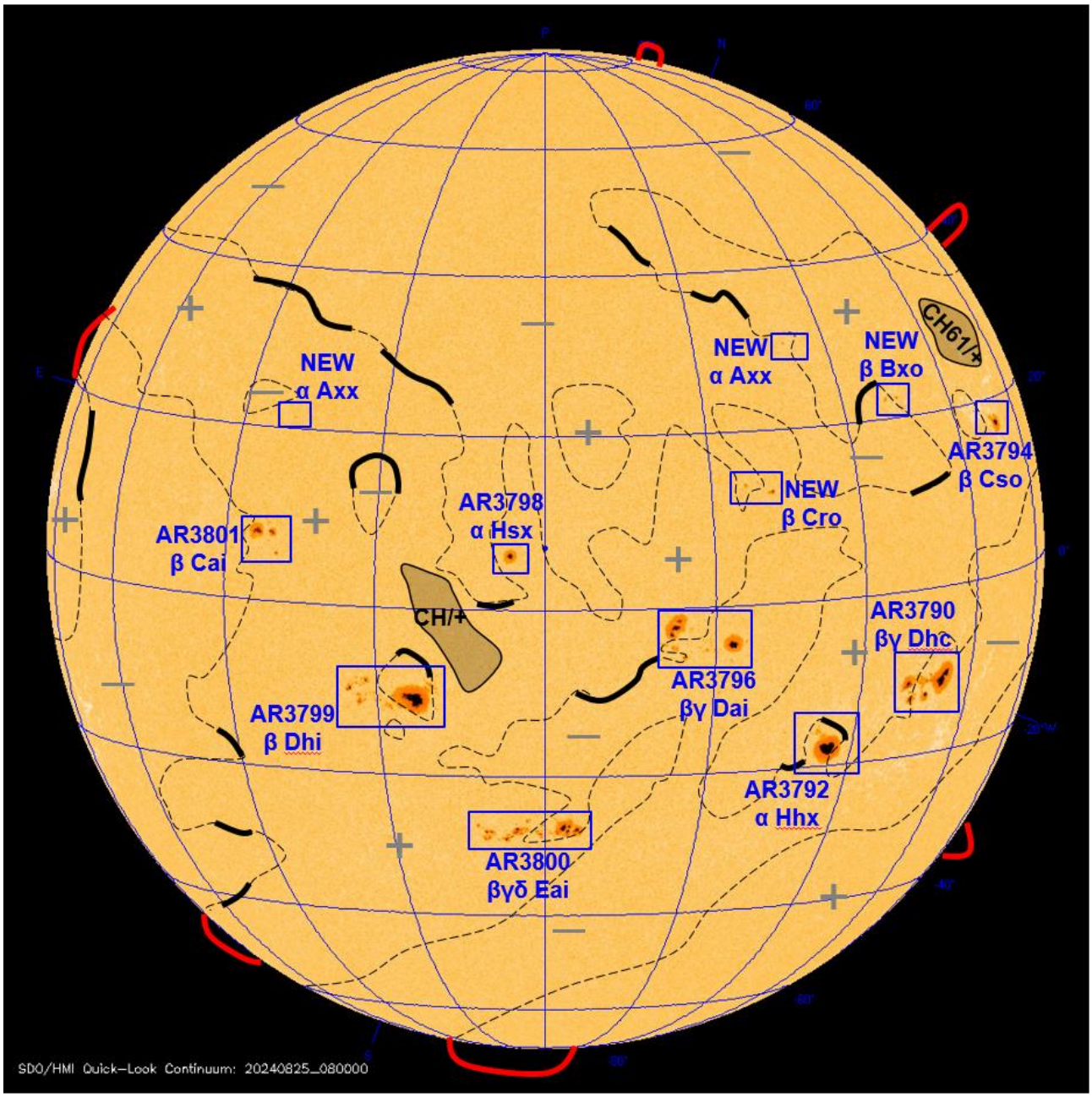
Figure 1. Solar Analysis Valid 25/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME from a filament eruption near AR3794 just after 23/0100UTC, has been assessed as passing mainly ahead of Earth, but with a glancing arrival likely early Day 3 (27 Aug). This has been delayed slightly based upon recent Enlil model runs.

Otherwise mainly background slow wind conditions are expected, with any fast wind from CH61 now assumed to have passed north of Earth. No other notable enhancements are currently forecast, with the slight enhancement indicated in MOSWOC Enlil from Day 3 (27 Aug) discounted as no clear potential source has been identified. Any fast wind from the unnumbered central disc coronal hole is currently not expected until beyond this forecast period.

Mainly Quiet geomagnetic activity is expected with a slight chance of Unsettled spells. There is a chance of Active to G1 Minor Storm with any CME glance, most likely day 3 (27 Aug).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	10	30	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/0858	Nil	C5 flare and filament nr. AR3794	NW	416 km/s	27/0600 UTC +/- 9hrs.	Low confidence, Glancing impact likely

Figure 2: ENLIL and ensemble, showing glancing arrival of CME on Day 3 (27 Aug)

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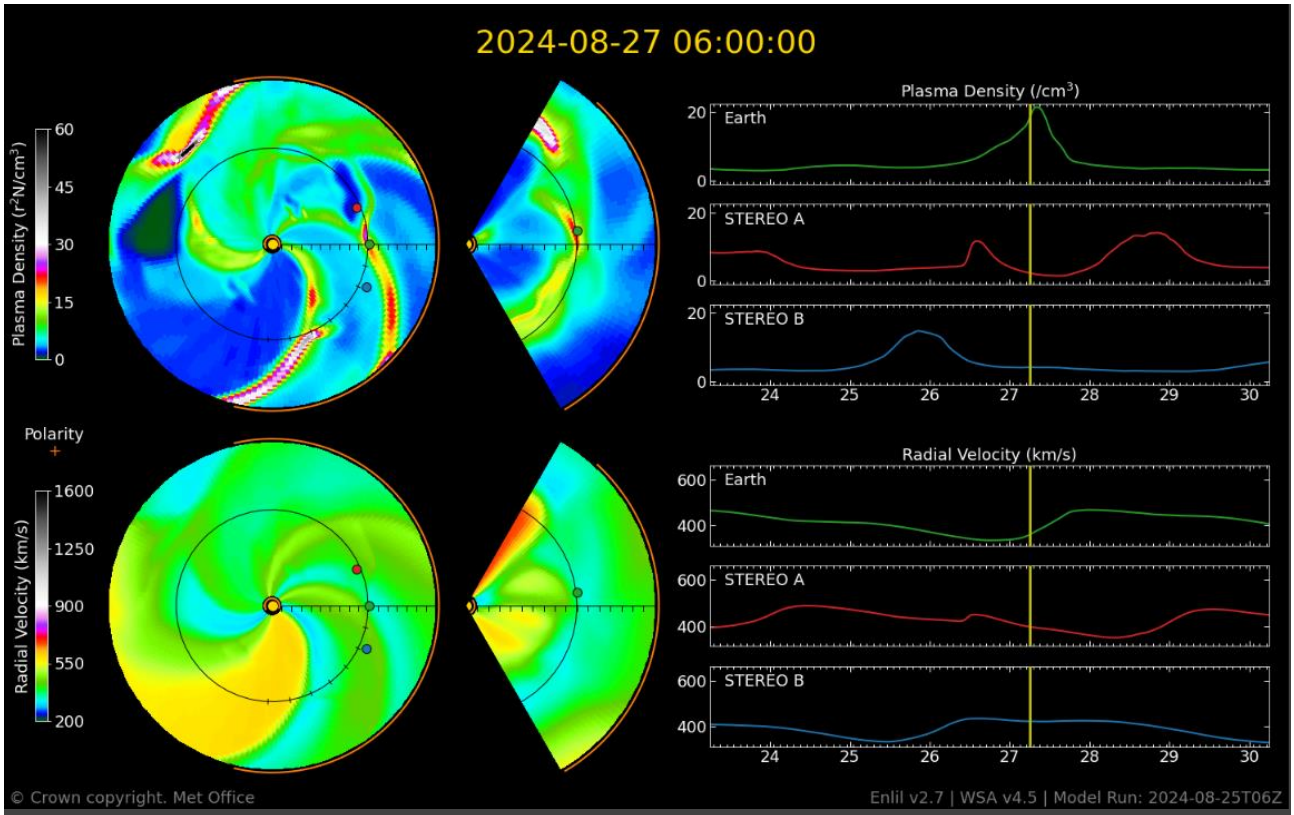

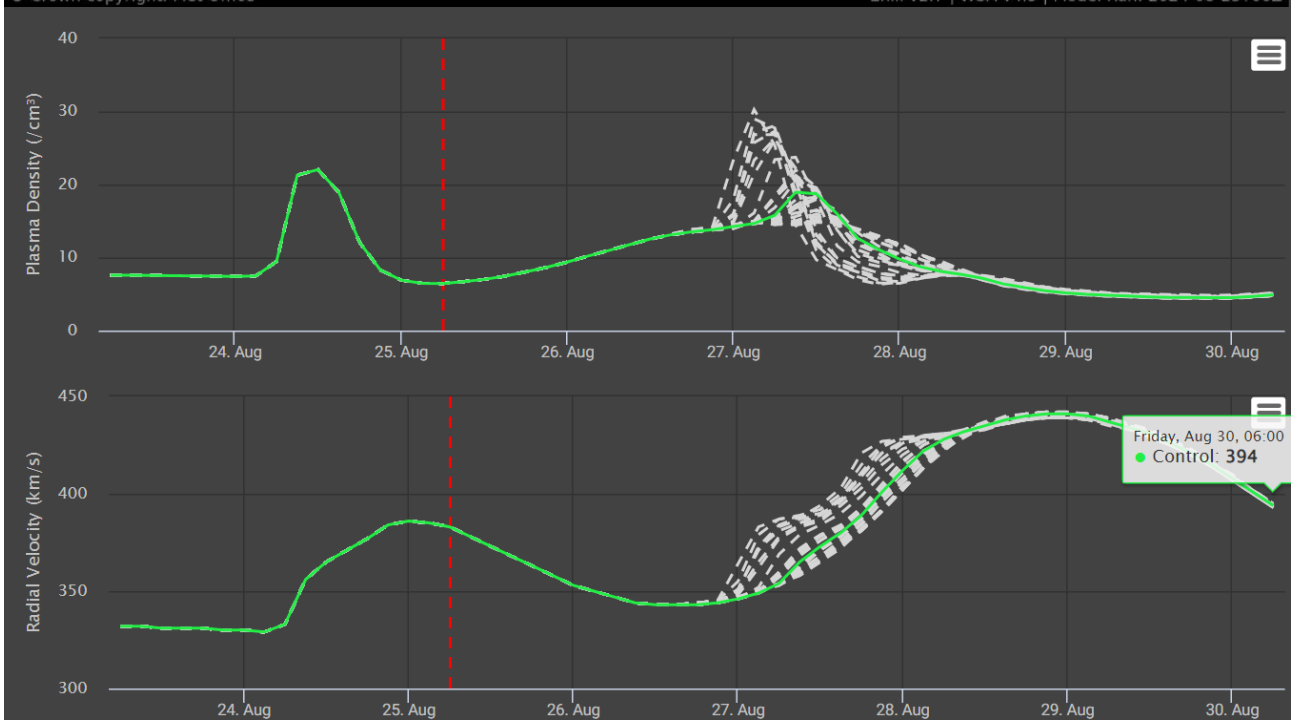

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Radio Blackouts - X-Ray Flares:

Moderate activity is likely to continue with further M-class flares expected and a slight chance of X-class flares.

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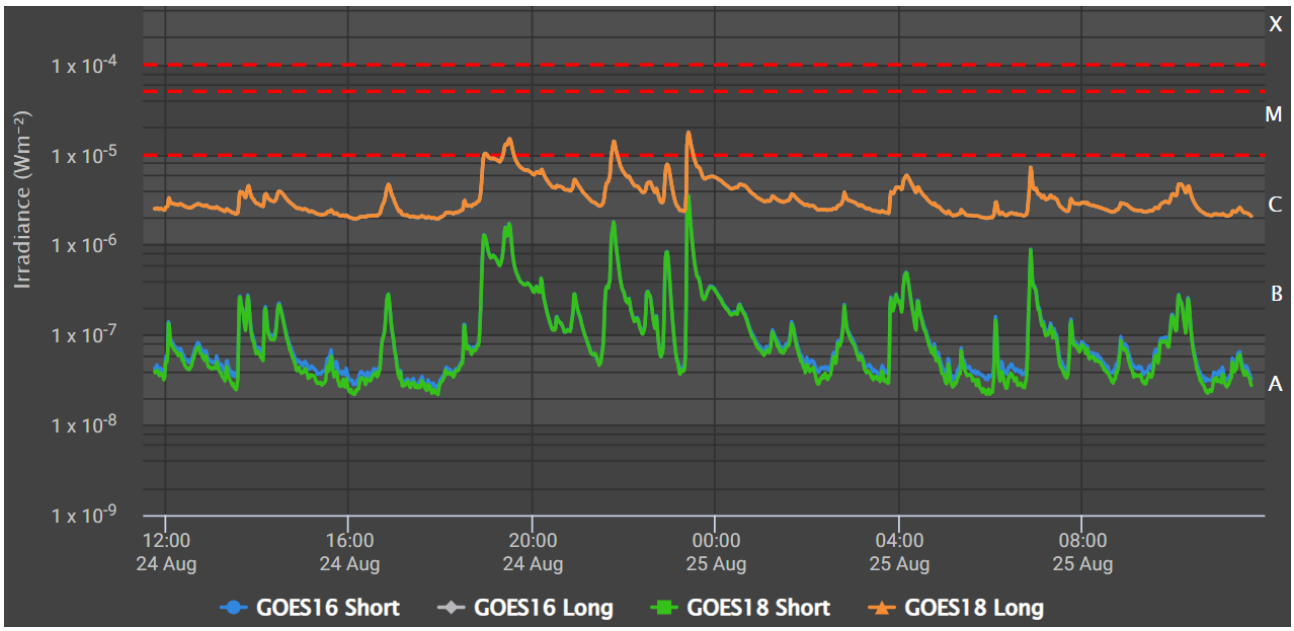
X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	80	80	75	70
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: GOES 16/18 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is currently at background and expected to persist at this level. There are a number of moderately sized sunspot regions on the disc, with occasional low M-flares likely. Furthermore, a number of these are now either in, or soon to move into the western hemisphere, that is favourable for any erupted protons to subsequently be observed at Earth. However the regions currently lack complexity that is ordinarily associated with the more proton rich events. Consequently, there is a chance that proton flux will rise given any notable flares, however this only gives a slight chance of exceeding the S1 Minor Radiation Storm threshold.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background and forecast to remain at this level. Any coronal hole solar wind enhancement on day one (24 Aug) is now forecast to be rather subdued, limiting the potential for any increases in the electron count at GEO.

Fluence is expected to remain below the Active (1e8 integrated pfu) threshold through the period. MOSWOC REFM is currently providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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